

(19)



Europäisches Patentamt

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(11)

**EP 0 708 573 A2**

(12)

**EUROPEAN PATENT APPLICATION**

(43) Date of publication:

**24.04.1996 Bulletin 1996/17**

(51) Int Cl.<sup>6</sup>: **H04Q 7/34**

(21) Application number: **95850176.9**

(22) Date of filing: **12.10.1995**

(84) Designated Contracting States:

**CH DE ES FR GB IT LI NL**

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(30) Priority: **20.10.1994 SV 9403586**

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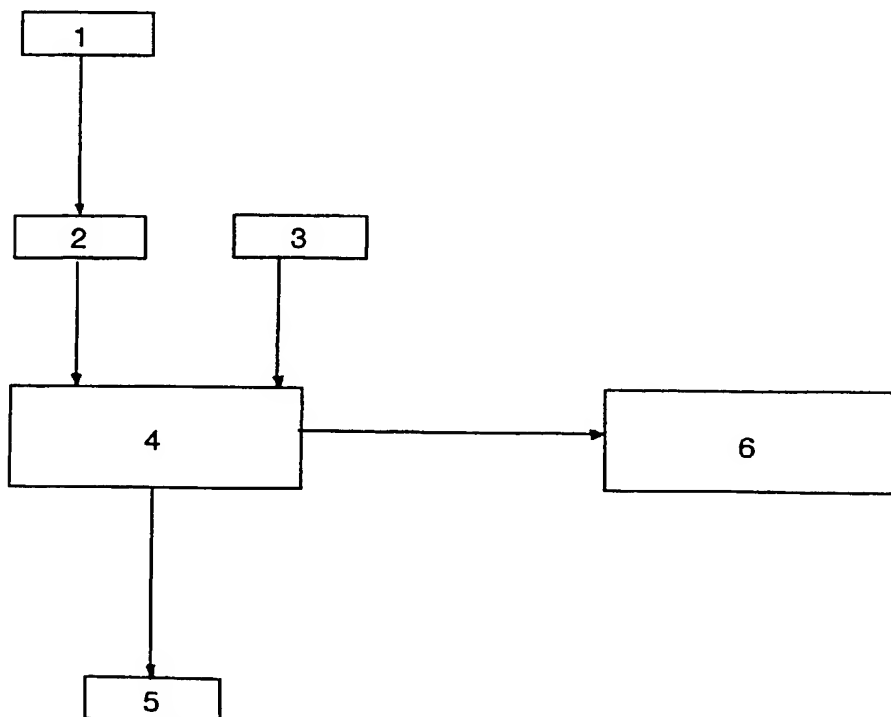
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**(54) Method and device for supervision of preferably mobile telephone systems**

(57) The idea of the invention is to introduce a so called expert system for control of traffic load, other counters in the exchanges/switches and other indata, if any, for instance signal strength data. An expert system can, based on previously experienced levels, predict within which limits different parameters should be. By the fact that the expert system initially can be "taught"

and continuously "further educated", the supervision of the traffic and the counters can be based on data which is normal for respective base station and point of time. By that a more delicate network for detection of faults in the system will be achieved, which results in that faults in the system will be earlier detected.



## Description

### TECHNICAL FIELD

The present invention relates to supervision of telecommunication systems; at the supervision are inter alia used counters which are arranged in the different parts of the system. Further there are used devices which control the current traffic situation. The knowledge which exists regarding the variations of the traffic during different periods of time is furthermore rationally used. Accordingly the invention allows that the supervision of telecommunication systems, especially mobile telephone systems, is made more effective and that faults are rapidly attended to.

### PRIOR ART

Previously have been suggested different systems and procedures to control a mobile telephone system by the American patent document 5289526, where is shown a system consisting of a central control unit which transmits control signals to the base stations and which has possibility to detect nonconformities in the transmission, as for instance phase faults, wave form defects etc. Further is shown by the American patent document 4443661 a method for detecting faults in a mobile telephone system. The method implies that the output on the receiver for the control channel in a base station is reported to a central test unit. If no signal is reported from a certain receiver within a certain time interval, certain measures are taken, among other things a test signal is transmitted to this receiver. If no answer is received, the test apparatus indicates that a fault exists in the base station.

### DESCRIPTION OF THE INVENTION

#### TECHNICAL PROBLEM

The supervision of a mobile telephone system today is in the main performed by control of the traffic load and different counters in the mobile telephone switches, MTX and MSC. This control is today mostly performed manually, which causes that a long time may elapse from the occurrence of a fault to detection of the fault. As an example can be mentioned that it occurs that base stations are idle for a longer period without responsible staff being informed. For certain important counters there are today threshold values which can be arranged in the switches. If the levels for these thresholds are exceeded, an alarm is generated to a supervisory center. The thresholds must be set high to cope with all natural variations in the mobile telephone traffic. This traffic varies for each base station with the time in the twenty four hours, week day, and time of the year. The statistics are however to a high degree repeated, as the same conditions regarding time exist. For instance is a normal Friday

forenoon one week much similar to the next week's Friday forenoon. The problem with using fixed threshold values are consequently that the system becomes very blunt to use, because all natural variations must be kept below the threshold value, in order not to cause false alarm too often.

### THE SOLUTION

The present invention relates in the first place to a method of supervision of preferably mobile telephone systems where parameters in the system are registered, and obtained values of the parameters indicate the functionality of the system. Threshold values for the different parameters are appointed with regard to season, week day, point of time of 24 hours, the current traffic situation etc. The obtained information is stored and used at appointment of future threshold values. The obtained history is further used, with an increasing accuracy, to appoint if faults in the system exist and early pay attention to this.

The method consequently allows that threshold values can be continuously adjusted when the system is in operation. Further the threshold values are adjusted individually for the different parts of the system, at which also regard is taken to trend changes which are registered.

In a further development of the invention an alarm is given when the threshold values are not fulfilled, and that the part of the system where the fault has been indicated is appointed. The invention further allows that trend changes can be predicted with regard to the present traffic situation and the stored history.

The invention further relates to a device for supervision of preferably mobile telephone systems where devices in the system register parameter values. The mentioned parameter values indicate the functionality of the system. Threshold values in the system are appointed by a device. The mentioned threshold values are given to the different parts of the system and shall be fulfilled. The device at that takes into consideration the current traffic situation and chronological data. The device appoints threshold values with an increasing accuracy in pace with that the stored information becomes more and more complete. When mentioned threshold values are not fulfilled, the device is arranged to start an alarm and appoint defective parts in the system. At the appointment of the threshold values the device takes into consideration both registered parameter values and the traffic situation. Adjustment of the threshold values are in this way possible to perform continuously in the different parts of the system.

In a further development of the invention the device is arranged to predict traffic situations and initially appoint threshold values with regard to the traffic situation, season, week day, time of the day etc. The device further appoints changes in the traffic situation and predict changes in the traffic situation. The threshold values are

appointed with regard to this. The device, which stores the previous history, appoints in this way the threshold values with an increased accuracy. Appointment of faults in the system and its different parts will at that be possible to perform with an increased accuracy.

#### ADVANTAGES

The present invention allows that the threshold values for supervision of telephone systems can be continuously updated with regard to the current traffic situation. Further it is possible to predict the traffic situation for different days and initially appoint threshold values which the different parameters in the system shall fulfil. Possibility at that exists to take into consideration for instance week day, time of the twenty-four hours, season etc. The invention in this way allows that the parameter values are appointed individually in the different parts of the system with regard to the current traffic situation. This together with the fact that the parameter values are appointed with an ever increasing accuracy results in that faults in the telecommunication system can be detected in an ever earlier stage. Consequently it is possible to obtain a system which has a high functionality.

#### DESCRIPTION OF FIGURES

The figure shows the fundamental build-up of the invention.

#### PREFERRED EMBODIMENT

In the following the idea of invention is described with reference to the figure and the terms therein.

The idea of the invention is to introduce a so called expert system for control of system load, other counters in the switches and, if any, other indata, for instance signal strength data. An expert system can, based on previously experienced levels, predict within which limits different parameters should be. By the fact that the expert system initially can be "taught" and continually "further educated", the supervision of the traffic and the counters can be based on data which is normal for respective base station and point of time. By this a considerably more delicate network for detection of faults in the system will be achieved, which results in that faults in the system will be detected earlier.

In a telecommunication system including for instance a stationary telephone network there are switching functions like exchanges and radio communication over base stations distributed in the network. In the different parts of the telecommunication network are counters and other devices arranged to register important data of the traffic. The mentioned data can for instance consist of the current traffic intensity, the signal strength on different channels, the existence of blockings in different parts of the network etc. The information from the telecommunication network, 1, is accordingly

transferred to traffic registering device, 2. This information is transferred to an expert system, 3. To the expert system are also other information, 4, transferred which is used by the expert system. The received information is stored in a data base, 5. In the data base is in this way stored different kinds of information regarding the traffic and the traffic managing in the telecommunication system. The information is at this referable to different points of time of the twenty-four hours, different weekdays, seasons etc. The expert system, 4, appoints, on the basis of the mentioned information, threshold values which the different parameters in the system shall contain. These calculations are performed continuously during the whole operating time of the system, at which the mentioned threshold values can be related to the real, existing situation.

The received information is transferred to a supervisory system, 6. When a parameter does not fulfil the mentioned threshold value, an alarm signal is given in the supervisory system. The alarm signal indicates on one hand from which part of the telecommunication system the alarm is coming, and on the other hand it can indicate separate devices or groups of devices from which the alarm originates. The expert system registers further and calculates trends in the development. This information can be used for predicting an expected traffic situation during a certain period of time. At this consideration is taken to that, for instance, corresponding days in one week to a great extent is similar to the traffic situation during corresponding days and points of time in a closely located week. This gives good opportunities to predict the expected traffic situation and preadjust the threshold values with regard to that. Further the prediction is used, from the real situation, to appoint the expected traffic situation during the nearest coming period of time.

The invention thus allows that the supervision of for instance a mobile telephone system is made much more effective. In the systems of to-day, where the supervision mainly is made by control of traffic load and different counters in the mobile telephone exchanges, MTX and MSC, this is performed manually. A very rapid detection of fault situations can at this be achieved, contrary to with the former systems where long time could elapse before a fault was detected. Further problems in the switching systems of to-day are avoided, where the threshold values must be set with large margins to cover all imaginable situations. Furthermore the threshold value is allowed to vary during the course of the day with consideration taken to the real traffic situation. Further the invention gives possibility to store and compare periods where the traffic situation is equivalent.

The invention further allows that threshold values can be arranged for more parameters than what is normally done in the systems of to-day. The invention thus allows that a more delicate instrument for detection of faults in a telecommunication system is achieved.

The invention is not restricted to the in the above

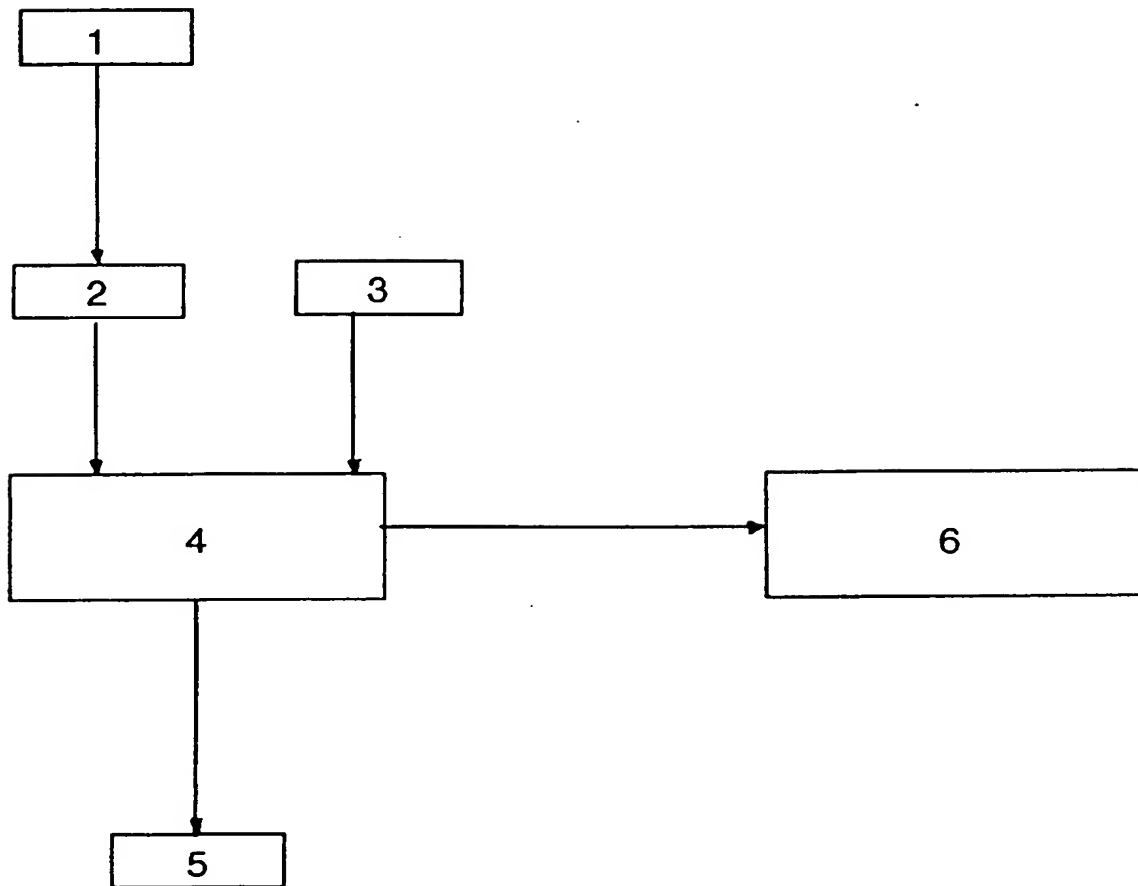
shown embodiment, but may be subjected to modifications within the frame of the following patent claims and idea of invention.

#### Claims

1. Method for supervision of preferably mobile telephone systems where parameters in the system are registered and obtained values of the parameters indicate the functionality of the system, **characterized** in that threshold values for the parameters are appointed with regard to for instance time of the year, week day, time of the twenty-four hour period, and the current traffic situation, that the registered parameter values and traffic situations are stored and used at future appointment of the threshold values, and that the threshold values are appointed with an increasing accuracy, at which faults in the system are noticable at an early stage.
2. Method according to patent claim 1, **characterized** in that the threshold values are adjusted continuously during operation.
3. Method according to any of the previous patent claims, **characterized** in that the threshold values are appointed individually for the different parts of the system.
4. Method according to any of the previous patent claims, **characterized** in that the threshold values are adjusted with regard to trend changes which are registered.
5. Method according to any of the previous patent claims, **characterized** in that alarm is given when any of the parameters does not fulfil the threshold values.
6. Method according to any of the previous patent claims, **characterized** in that the part of the system which is indicated as faulty is pointed out.
7. Method according to any of the previous patent claims, **characterized** in that trend changes are predicted with regard to the present traffic situation and history.
8. Device for supervision of preferably mobile telephone systems where devices in the system register parameter values, which indicate the functionality of the system, **characterized** in that the device is arranged to appoint threshold values which the different parts of the system shall fulfil, that the device is arranged to take into consideration the current traffic situation and chronological data, and that the device is arranged to appoint the threshold

values with increasing accuracy, at which the device is arranged to give an alarm and point out faulty parts in the system.

9. Device according to patent claim 8, **characterized** in that the device is arranged to store registered parameter values and traffic situations, and that the device takes into consideration the obtained history at the appointment of the threshold values.
10. Device according to any of the patent claims 8 or 9, **characterized** in that the device is arranged to continuously change the threshold values during operation, and that the mentioned change of the threshold values are made individually in the different parts of the system.
11. Device according to any of the patent claims 8-10, **characterized** in that the device is arranged to predict a current traffic situation and initially appoint the threshold values with regard to, for instance, the traffic situation, season, weekday and hour of the twenty-two hours.
12. Device according to any of the patent claims 8-11, **characterized** in that the device is arranged to appoint and predict changes in the traffic situation and that the threshold values are appointed with regard to that.
13. Device according to any of the patent claims 8-12, **characterized** in that the device is arranged to appoint the threshold values with an increasing accuracy and that the device is arranged to appoint faults in the system and its different parts with an increasing accuracy.







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(11) **EP 0 708 573 A3**

(12) **EUROPEAN PATENT APPLICATION**

(88) Date of publication A3:  
06.08.1997 Bulletin 1997/32

(51) Int Cl.<sup>6</sup>: **H04Q 7/34**

(43) Date of publication A2:  
24.04.1996 Bulletin 1996/17

(21) Application number: **95850176.9**

(22) Date of filing: **12.10.1995**

(84) Designated Contracting States:  
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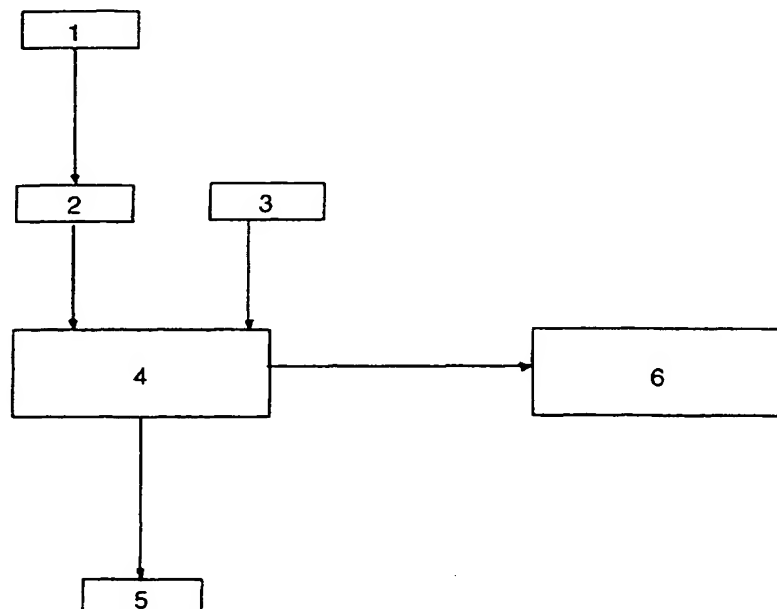
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## EUROPEAN SEARCH REPORT

Application Number  
EP 95 85 0176

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
A	INTERNATIONAL CONFERENCE ON DIGITAL LAND MOBILE RADIO COMMUNICATIONS, 30 June 1987, pages 497-506, XP002011123 KALL J ET AL: "MAINTENANCE INFORMATION IN THE GSM SYSTEM" * paragraph 3.1 * * paragraph 4.2.2 * * paragraph 4.3.3 *	1,5,6,8, 9,13	H04Q7/34
A	WO 93 15569 A (COMARCO INC) 5 August 1993  * abstract * * page 5, line 5 - page 5, line 24 * * page 30, line 11 - page 31, line 26 * * page 37, line 14 - page 38, line 26 * * page 40, line 6 - page 40, line 11 *	1,4-9, 11-13	
A	GB 2 252 475 A (MOTOROLA INC) 5 August 1992 * abstract * * page 5, line 27 - page 6, line 29 *	1,5,6,8, 9	TECHNICAL FIELDS SEARCHED (Int.Cl.6)
A	REVIEW OF THE ELECTRICAL COMMUNICATION LABORATORIES, MARCH 1982, JAPAN, vol. 30, no. 2, ISSN 0029-067X, pages 279-286, XP002032526 MITSUISHI T ET AL: "Supervisory system design for medium capacity cell site system (land mobile telephone system)" * paragraph 2.1 - paragraph 2.2 *	6,13	H04Q H04M
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 6 June 1997	Examiner Maalismaa, J
CATEGORY OF CITED DOCUMENTS X: particularly relevant if taken alone Y: particularly relevant if combined with another document of the same category A: technological background O: non-written disclosure P: intermediate document		T: theory or principle underlying the invention E: earlier patent document, but published on, or after the filing date D: document cited in the application L: document cited for other reasons *: member of the same patent family, corresponding document	

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